

(19)



(11)

EP 2 568 882 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
13.09.2017 Bulletin 2017/37

(51) Int Cl.:
A61B 6/14 (2006.01) **A61B 6/08** (2006.01)
G03B 42/02 (2006.01) **G03B 42/04** (2006.01)

(21) Application number: **10752386.2**

(86) International application number:
PCT/IB2010/001422

(22) Date of filing: **12.05.2010**

(87) International publication number:
WO 2011/141763 (17.11.2011 Gazette 2011/46)

(54) ALIGNMENT APPARATUS FOR DENTAL INTRAORAL RADIOGRAPHY

AUSRICHTUNGSVORRICHTUNG FÜR INTRAORALES ZAHNRÖNTGEN

APPAREIL D'ALIGNEMENT POUR RADIOGRAPHIE INTRABUCCALE DENTAIRE

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO SE SI SK SM TR**

(43) Date of publication of application:
20.03.2013 Bulletin 2013/12

(73) Proprietor: **Trophy**
77435 Marne La Vallée Cedex 2 (FR)

(72) Inventors:
• **INGLESE, Jean-Marc**
F-77437 Bussy-Saint-Georges (FR)

• **BOTHOREL, Sylvie**
F-75013 Paris (FR)

(74) Representative: **Wagner, Karl H.**
Wagner & Geyer
Gewürzmühlstrasse 5
80538 München (DE)

(56) References cited:
WO-A1-2004/017833 WO-A1-2006/061357
WO-A2-2007/149402 JP-A- 2007 029 353
US-A- 5 463 669 US-A1- 2009 060 145

EP 2 568 882 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

FIELD OF THE INVENTION

[0001] The invention relates generally to diagnostic imaging and more particularly to an apparatus for aligning an x-ray beam with an intra-oral image detector for dental radiography and an imaging system using such an apparatus.

BACKGROUND OF THE INVENTION

[0002] In conventional diagnostic radiography, an object is placed between an x-ray radiation source and a detector and the relative positions of the source and detector are positioned for proper alignment and angle for obtaining an image. When the object is an arm, leg, or chest of a patient, the x-ray tube and the detector are visible to the x-ray technician and can be easily aligned.

[0003] Alignment is more difficult for dental or intraoral radiography. The detector position is within the patient's mouth and is not visible to the technician. Instead, the technician typically places the detector into some type of holder, and then inserts the holder into place in the mouth. The holder may have a bite plate or other type of supporting member that helps to position the detector appropriately. As is well known, holders of this type can be cumbersome and uncomfortable to the patient. Holders and other positioning devices are not error-proof, and positioning errors with these devices can mean that the images obtained are not suitable for diagnosis. Poorly aligned detectors can be the cause of problems such as cone cuts, missed apices, and elongation and related angulation or parallax errors, for example. These alignment problems can result in re-takes, additional image captures to acquire an acceptable image. Re-takes are undesirable due to the additional x-ray radiation exposure to the patient and prolonged patient discomfort with the sensor in the mouth.

[0004] Conventional x-ray sources have included aim indicators that help the technician adjust the position and angle of the x-ray source. Often these aim indicators use visible light to trace an outline that helps to center the radiation beam. These work well where the radiation detector can be seen, but fall short of what is needed where the detector is not visible, such as with intraoral imaging. The technician must guess or estimate both the position of the intraoral sensor and the angle of incidence of x-rays on the sensor.

[0005] The simplified schematic of Figures 1A and 1B show how mis-alignment between an x-ray source 10 and a detector 20 can occur. In these examples, x-ray source 10 provides visible light aim indices 12 used for aim centering. When correct aim alignment is achieved, shown at example (a), detector 20 is centered, as shown within aim indices 12. Aim is incorrect at examples (b) and (d).

[0006] For best imaging results, proper alignment with

respect to angle, or angulation, is also needed. Incident radiation from x-ray source 10 is preferably orthogonal to detector 20 as shown in example (a). Line N in Figure 1 indicates a normal, or orthogonal line, to the surface of detector 20. Examples (c) and (d) show incorrect angular alignment. In example (c), aim is correct but angulation is incorrect. In example (d), both aim and angulation are incorrect. In example (e), detector 20 is rotated in plane.

[0007] It is instructive to note that the schematic examples of Figures 1A and 1B assume an orthogonal positioning of x-ray source 10 to detector 20. In some embodiments, an oblique orientation may be used.

[0008] One proposed solution to the problem of positioning an intraoral sensor relative to the x-ray source is described in U.S. Patent Application Publication No. 2009/0060145 entitled "POSITIONING ADJUSTMENT OF A MOBILE RADIOLOGY FACILITY" by Tranchant et al. The apparatus described in Tranchant et al. '0145 uses an arrangement of electromagnetic emitters, such as radio frequency (RF) emitters, in cooperation with a sensor (reception unit) to determine the position and angle of an intraoral detector with respect to an x-ray source. Mis-alignment can then be reported to the operator on an operator console or display screen.

[0009] The solution proposed in the Tranchant et al. '0145 disclosure can detect and report mis-alignment for intraoral radiography and can minimize or eliminate the need to use cumbersome positioning devices within the patient's mouth. However, some practical difficulties remain. The technician needs information in order to correct for mis-alignment and to verify that proper alignment has been obtained. Conventional methods for reporting the alignment information, such as providing information on an operator console, for example, can be difficult to use when making position adjustments. The technician needs to move back and forth between the operator console and the x-ray tube, checking and correcting each adjustment until proper alignment is achieved.

[0010] Thus, there is a need for an apparatus and method for providing improved alignment of the radiation source and image detector in intraoral radiography.

[0011] Furthermore, reference is made to WO 2006 061 357 A1, which relates to a mammography apparatus in which an x-ray source and a detector are mounted on a U-bracket. Furthermore a clamping device on the U-bracket is provided for allowing a breast to be examined to be fixed in a certain position. The detector may be movable along the bracket to allow different areas of the breast to be imaged and the x-rays being irradiated onto the breast may be limited to a certain region corresponding to a position of the detector by means of an adjustable aperture. To facilitate such limiting functionality, a laser pointer is provided on the bracket to provide a visible indication on the surface of the breast, indicating the location of the detector.

[0012] JP 2007 029 353 A relates to radiographic equipment having the capability of superimposing a radiation field of the X-ray irradiation mechanism and an

X-ray detecting field of a radiation detector on the body surface of a subject as visually recognizable images. The capability is provided by the irradiation optics of the X-ray irradiation mechanism.

SUMMARY OF THE INVENTION

[0013] An object of the present invention is to advance the art of intraoral radiography by providing apparatus and methods that improve the ability to align the radiation source and detector.

[0014] An advantage provided by the present invention is the rapid visualization of adjustment necessary to bring the radiation source and image detector into alignment.

[0015] These objects are given only by way of illustrative example, and such objects may be exemplary of one or more embodiments of the invention. Other desirable objectives and advantages inherently achieved by the disclosed invention may occur or become apparent to those skilled in the art. The invention is defined by the appended claims. In particular, an apparatus and a method for obtaining an intraoral x-ray image according to the invention are respectively defined in independent claims 1 and 12.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of the embodiments of the invention, as illustrated in the accompanying drawings. The elements of the drawings are not necessarily to scale relative to each other.

FIGS. 1A and 1B are simplified schematic block diagrams that show different aspects of the alignment problem.

FIG. 2 is a schematic block diagram showing an imaging apparatus that calculates the lateral position and angular orientation of an intraoral image detector.

FIG. 3 is a schematic block diagram showing an imaging apparatus that calculates the lateral position and angular orientation of an intraoral image detector and projects a display onto the patient's cheek.

FIG. 4 is a schematic diagram that shows how triangulation is used for position detection in one embodiment of the present invention.

FIG. 5 is a perspective view showing an intraoral x-ray imaging apparatus according to one embodiment, in which alignment is not correct.

FIG. 6 is a perspective view showing an intraoral x-ray imaging apparatus according to one embodiment, in which alignment is correct.

DETAILED DESCRIPTION OF THE INVENTION

[0017] The following is a detailed description of the pre-

ferred embodiments of the invention, reference being made to the drawings in which the same reference numerals identify the same elements of structure in each of the several figures.

[0018] In the present disclosure, the term "detector" refers to the element that is placed in the patient's mouth, receives radiation, and provides the image content. Such a detector may be a photosensitive film element having a piece of film in a sleeve or film holder, wherein the film is separately developed to provide the x-ray image, a phosphor storage element that is separately scanned to provide x-ray image data, or a digital detector that provides the x-ray image data directly to an imaging system.

[0019] As the simplified schematic of Figures 1A and 1B showed, lateral (side-to-side) position of detector 20 and angulation of the detector 20 inside the patient's mouth are important factors for achieving good alignment. Rotation of the detector within its plane (that is, rotation about orthogonal axis N) as shown at (e) in Figure 1B is less important, but can be a consideration for maintaining the desired alignment.

[0020] In order to better understand the parts and operation of the apparatus of the present invention, it is helpful to show how proper alignment can be detected by an imaging system. Referring to the block diagram of Figure 2, there is shown an intraoral imaging apparatus 22 that detects alignment of imaging detector 20 with x-ray source 10. One example of such a system is given in the Tranchant et al. '0145 disclosure described previously.

[0021] In the Figure 2 arrangement, detector 20 is placed adjacent to a tooth 14, inside a cheek 18 of the patient. Incorporated as part of detector 20 are a number of detectable elements 30, which are shown as electromagnetic signal emitters, such as radio-frequency (RF) emitters. Detectable elements 30 are typically spaced apart from each other in order to provide triangulation information, as Tranchant et al. '0145 describes. A sensor 24, itself aligned and positionally coupled with x-ray source 10, senses the presence of detectable element 30 in some way, such as by sensing emitted RF signals. Methods for energizing and sensing RF emitters, such as the tiny emitters used in RFID tags, for example, are well known to those in the signal detection arts. A control logic processor 26, in signal communication with one or more sensors 24, employs conventional trigonometric calculations based on the received signals from, or other detectable features of, detectable elements 30 and the known position of sensor 24 with relation to x-ray source 10. This is performed in order to determine the corresponding positional and angular alignment of detector 20 in the patient's mouth relative to x-ray source 10. An operator console display 28 then indicates alignment information for the operator and may recommend the needed adjustment settings. Sensors 24 are energizable to receive electromagnetic signals of one or more predetermined frequencies.

[0022] Embodiments of the present invention improve

upon the basic system of Figure 2 by providing alignment information to the technician where it can be more easily used. The alignment apparatus of the present invention projects an image onto the cheek of the dental patient as a guide for proper alignment of the x-ray tube with respect to the position and angle of the detector. Referring to an embodiment of an imaging apparatus 36 in Figure 3, control logic processor 26 obtains alignment information in similar manner to that described in Figure 2. In addition, control logic processor 26 is also in image data signal communication with a projector 40 for projecting an image onto the patient's cheek 18, lips, or face.

[0023] The perspective view of Figure 4 shows, in schematic form, how triangulation is used to indicate position and angle of detector 20 in order to determine alignment offset in one embodiment. Sensors 24a and 24b, RF transceivers in one embodiment, are at a known position relative to the x-ray source 10, such as mounted near the x-ray source on the x-ray tube, for example. Signal emitters or other type of detectable elements 30 are typically disposed in pairs, positioned at corners of detector 20. Each detectable element 30 has a detectable feature that can be sensed by sensors 24a and 24b. In one embodiment, each detectable element 30 is an RF device that generates an electromagnetic field, such as in response to a transmitted signal from its corresponding signal receiver, sensors 24a or 24b. Phase, intensity, or other characteristic of the emitted electromagnetic field is measured at the corresponding sensors 24a and 24b, and is used in order to determine relative distance between emitting and receiving components. For the RF detection embodiment of Figure 4, for example, when signals for each pair of emitters, acting as detectable elements 30, are in phase, good alignment has been achieved. An out-of-phase condition indicates poor alignment and can indicate the needed direction for adjustment. Sensors 24a and 24b are in signal communication with control logic processor 26.

[0024] In a similar manner, relative signal strength could alternately be used to indicate the position and angle of detector 20 with respect to the x-ray source for determining alignment offset. Using this approach in an RF embodiment, the nearest signal emitter acting as detectable element 30 has, correspondingly, the strongest intensity signal at sensor 24a or 24b. When the arrangement of Figure 4 is used, signals of equal intensity emitted from all four emitters or other type of detectable element 30 indicate good alignment. When signal intensities vary, the pattern for their variation can be used to indicate which adjustments are needed. As one example, the Tranchant et al. '0145 disclosure, noted previously, describes a position detection system that uses triangulation and sensing of multiple emitted signals to compute alignment positioning. It can be appreciated that any of a number of different configurations can be used for determining proper alignment using one or more sensors 24 and detectable elements 30, as is well known to those skilled in the signal processing and position sensing arts.

[0025] Referring to the perspective views of Figures 5 and 6, the added advantage of embodiments of the present invention is shown. Projector 40, positionally coupled to x-ray source 10, such as mounted in position toward the end of the x-ray tube or on some other portion of the x-ray system, for example, projects a two-dimensional image onto the patient's cheek in order to indicate a position 42 of the concealed detector 20 (shown in dotted outline) and, also to indicate the aim indices 12 of the x-ray source. Figure 5 shows an example in which aim alignment is incorrect, since position 42 is not aligned with aim indices 12. Figure 6 shows an example in which aim alignment is correct, with position 42 centered between aim indices 12.

[0026] Projector 40 can be any of a number of types of imaging projector that can be mounted onto x-ray source 10. In one embodiment, projector 40 is a pico-projector, such as a Pico Projector Display from Microvision Inc., Redmond, WA, USA, for example. Devices such as these are advantaged for a number of reasons, including small size, low weight, and low power requirements. These pico-projectors, used in cell-phone and other highly portable electronic devices, scan one or more low-power lasers onto a display surface. The pico-projector requires a minimum of optical components for projection over a range of distances. The laser itself is turned on and off rapidly as needed, so that power is consumed only for those image pixels that are projected. This allows the pico-projector to operate at low power levels, so that battery power could be used for projector 40. Alternate embodiments use other types of electronic imaging projectors, such as those that employ a digital micromirror array such as the Digital Light Processor (DLP) from Texas Instruments, Inc.; an array of micro-electromechanical grating light valves, such as the Grating Light Valve (GLV) device from Silicon Light Machines, Inc.; or a liquid crystal device (LCD) including a Liquid Crystal on Silicon (LCOS) device.

[0027] Where lasers are used as illumination sources in projector 40, additional measures can be taken to minimize incidence of coherent laser light to the eyes of the patient or practitioner. Very low power lasers would be used, at scanning rates that deliver only a very small amount of light intensity at any point. A diffusive element may be provided in the light path, for example, to provide some scattering of the laser light, reducing intensity with little or no effect on the quality or utility of the projected image. Light-emitting diodes (LEDs) or other low-power solid-state light sources could alternately be used, such as organic LED (OLED) devices.

[0028] The image that is projected by projector 40 can take any of a number of forms and includes both aim indicia 12 for the x-ray source and position 42 indicator for detector 20. Because projector 40 employs a two-dimensional imaging device, the displayed image can have multiple parts and may include additional text fields, direction markers, and other elements. Position 42 may be shown in outline form, as shown in Figures 4 and 5,

or may be represented in some other way. In one embodiment, the value of angular offset of detector 20 is indicated on the patient's cheek as a displayed numerical message. Alternately, animation or other capabilities of projector 40 could be used to provide additional position and angle information.

[0029] Color can be used to help indicate the relative amount of alignment offset in various ways. For example, even with the outline of detector 20 projected on the cheek surface, it can be difficult for the technician to know how to adjust for angular alignment. Display of indicia 12 and position 42 in different colors can help to guide the technician in adjusting the angle of the x-ray tube until both aim indicia 12 and position 42 display in the same color, for example. Blinking of the display or of different portions of the displayed elements can also help to indicate and guide alignment adjustments. An audible beep may be provided to indicate acceptable or unacceptable alignment. Stationary indicators, such as arrows or target symbols can be projected onto the cheek of the patient. Animation can be provided to guide adjustment.

[0030] The invention has been described in detail with particular reference to a presently preferred embodiment, but it will be understood that variations and modifications can be effected within the scope of the invention. For example, control logic processor 26 (Figures 2 - 4) can be any of a number of types of logic processing device, including a computer or computer workstation, a dedicated host processor, a microprocessor, logic array, or other device that executes stored program logic instructions. Control logic processor 26 may also connect to detector 20 for obtaining an image and for controlling the operation of signal emitters 30. The electromagnetic signals emitted and detected for determining position can be any of a number of types of signal, such as RF signals in the 10kHz - 100 MHz range, for example.

[0031] Embodiments shown and described with reference to Figures 2 and 3 showed use of radio frequency transmission and reception for identifying the position of intra-oral imaging detector 20. In such an embodiment, detectable element 30 is an RF emitter, such as an RFID device. Alternately, detectable element 30 can emit some other electromagnetic signal, such as light, for example. A bright light source from within the mouth may be perceptible to a sensor, particularly where the light is incident upon less dense tissue, such as the cheek. The light can be from within or outside of the visible spectrum. In yet another embodiment, ultrasound signals are emitted from detectable element 30 and sensed at sensor(s) 24. Yet another embodiment employs magnets as detectable elements 30 and uses magnetic attraction as a guide to determining the position and angular orientation of detector 20 within the patient's mouth.

[0032] The presently disclosed embodiments are therefore considered in all respects to be illustrative and not restrictive. The scope of the invention is indicated by the appended claims.

PARTS LIST

[0033]

5	10.	X-ray source
	12.	Aim index
	14.	Tooth
	18.	Cheek
	20.	Detector
10	22.	Imaging apparatus
	24, 24a, 24b.	Sensor
	26.	Control logic processor
	28.	Display
	30.	Sensed element
15	36.	Imaging apparatus
	40.	Projector
	42.	Position

20 Claims

1. An apparatus for obtaining an intraoral x-ray image from a patient, the apparatus comprising:

25 an x-ray source (10);
 an intraoral image detector (20) comprising one or more detectable elements (30);
 one or more sensors (24, 24a, 24b) positionally coupled near the x-ray source (10) and energizable to sense the location of the one or more detectable elements (30) when the intraoral image detector (20) is within the patient's mouth;
 30 a control logic processor (26) in signal communication with the one or more sensors (24, 24a, 24b) and responsive to stored instructions for calculating a position and angle alignment of the intraoral image detector (20) relative to the x-ray source (10), wherein the angle alignment relates to the angle alignment between incident radiation from the x-ray source and a normal, or orthogonal line, to the surface of the intraoral image detector (20); and

35 **characterised in that** it further comprises a projector (40) positionally coupled to the x-ray source (10) and in signal communication with the control logic processor (26) and energizable to project a 2D image comprising aim indicia (12) for the x-ray source, a position (42) indicator and an angle alignment offset indicator of the intraoral image detector (20) relative to the x-ray source (10) toward the calculated intraoral image detector (20) position in response to signals from the control logic processor (26).
 40
 45

2. The apparatus of claim 1 wherein the intraoral image detector (20) is taken from the group consisting of: a photosensitive film imaging device, a storage phosphor imaging device, and a digital detector device.

3. The apparatus of claim 1 wherein the projector (40) is configured to project an image using laser illumination.
4. The apparatus of claim 1 wherein at least one of the one or more sensors (24, 24a, 24b) is mounted on the x-ray source (10). 5
5. The apparatus of claim 1 wherein the one or more detectable elements (30) are configured to emit an electromagnetic signal at radio-frequency or light. 10
6. The apparatus of claim 1 wherein the one or more detectable elements (30) comprise a plurality of signal emitters, wherein each signal emitter is energizable to emit an electromagnetic signal at one or more predetermined frequencies, and wherein the one or more sensors (24, 24a, 24b) comprises one or more signal receivers positionally coupled with the x-ray source (10) and energizable to receive the electromagnetic signals from the signal emitters. 15 20
7. The apparatus of claim 1 wherein the one or more detectable elements (30) comprises a magnet. 25
8. The apparatus of claim 1 wherein the projector (40) uses a digital micromirror array or a liquid crystal device.
9. The apparatus of claim 1, wherein the projector (40) is adapted to project the position (42) indicator at least partially outside the aim indicia for the x-ray source. 30
10. The apparatus of claim 1 wherein at least one of the sensors (24, 24a, 24b) is a radio frequency transceiver. 35
11. The apparatus of claim 1 wherein the projected image varies in appearance according to an alignment offset between the x-ray source (10) and the intraoral image detector (20). 40
12. A method for obtaining an intraoral x-ray image comprising: 45
 - emitting a plurality of signals from signal emitters (30) associated with an intraoral image detector (20);
 - sensing the plurality of emitted signals using sensors (24, 24a, 24b) positionally coupled near an x-ray source (10);
 - calculating a position and angle alignment of the intraoral image detector (20) relative to the x-ray source (10) according to the sensed signals, wherein the angle alignment relates to the angle alignment between incident radiation from the x-ray source and a normal, or orthogonal line,

to the surface of the intraoral image detector (20);

characterised in that the method further comprises projecting a 2D image indicative of the position and angle alignment information toward the calculated detector position, wherein the 2D image comprises aim indicia (12) for the x-ray source, a position (42) indicator and an angle alignment offset indicator of the intraoral image detector (20) relative to the x-ray source (10) for guiding alignment adjustments.

13. The method of claim 12 wherein projecting the image comprises projecting an outline representative of the image detector (20).
14. The method of claim 12 wherein projecting the image comprises projecting an image representative of the image detector (20) and further comprising using a color that indicates the relative amount of an alignment offset.
15. The method of claim 12 wherein the angle alignment offset indicator includes at least one of a numerical message, color.

Patentansprüche

1. Vorrichtung zum Erhalten eines intraoralen Röntgenbildes von einem Patienten, wobei die Vorrichtung Folgendes aufweist:

eine Röntgenstrahlquelle (10);
 einen intraoralen Bilddetektor (20), der ein oder mehr detektierbare Elemente (30) aufweist;
 ein oder mehr Sensoren (24, 24a, 24b), die in der Nähe der Röntgenstrahlquelle (10) positionell gekoppelt sind und erregbar sind, um die Position der einen oder mehr detektierbaren Elemente (30) zu erfassen, wenn der intraorale Bilddetektor (20) innerhalb des Mundes des Patienten ist;
 einen Steuerlogikprozessor (26), der in Signalverbindung mit dem einen oder mehr Sensoren (24, 24a, 24b) steht, und auf gespeicherte Befehle zum Berechnen einer Position und Winkelausrichtung des intraoralen Bilddetektors (20) bezüglich der Röntgenstrahlquelle (10) reagiert, wobei die Winkelausrichtung mit der Winkelausrichtung zwischen der Einfallstrahlung von der Röntgenstrahlquelle und einer normalen oder orthogonalen Linie zu der Oberfläche des intraoralen Bilddetektors (20) in Beziehung steht; und
gekennzeichnet dadurch, dass sie ferner Folgendes aufweist:

- einen Projektor (40), der positionell mit der Röntgenstrahlquelle (10) gekoppelt ist, und in Signalverbindung mit dem Steuerlogikprozessor (26) steht und erregbar ist, um ein 2D-Bild zu der berechneten intraoralen Bilddetektor- (20) Position zu projizieren, das ein Zielindicia (12) für die Röntgenstrahlquelle, einen Positions- (42) Indikator und einen Winkelausrichtungs-Offset-Indikator des intraoralen Bilddetektors (20) aufweist bezüglich der Röntgenstrahlquelle (10), und zwar ansprechend auf Signale von dem Steuerlogikprozessor (26).
2. Vorrichtung nach Anspruch 1, wobei der intraorale Bilddetektor (20) aus einer Gruppe bestehend aus einer Abbildungsvorrichtung mit photosensitivem Film, einer Speicherphosphor-Abbildungsvorrichtung und einer digitalen Detektorvorrichtung kommt.
 3. Vorrichtung nach Anspruch 1, wobei der Projektor (40) konfiguriert ist, um ein Bild durch Nutzung von Laserillumination zu projizieren.
 4. Vorrichtung nach Anspruch 1, wobei wenigstens einer der einen oder mehr Sensoren (24, 24a, 24b) an die Röntgenstrahlquelle (10) montiert sind.
 5. Vorrichtung nach Anspruch 1, wobei die einen oder mehr detektierbaren Elemente (30) konfiguriert sind zum Emittieren eines elektromagnetischen Signals mit Hochfrequenz oder Licht.
 6. Vorrichtung nach Anspruch 1, wobei die einen oder mehr detektierbaren Elemente (30) eine Vielzahl von Signalemittern aufweisen, wobei jeder Signalemitter erregbar ist, um ein elektromagnetisches Signal an einer oder mehr vorbestimmten Frequenzen zu emittieren, und wobei die ein oder mehr Sensoren (24, 24a, 24b) ein oder mehr Signalempfänger aufweisen, die positionell gekoppelt sind mit der Röntgenstrahlquelle (10) und erregbar sind, um die elektromagnetischen Signale von den Signalemittern zu empfangen.
 7. Vorrichtung nach Anspruch 1, wobei die einen oder mehr detektierbaren Elemente (30) einen Magneten aufweisen.
 8. Vorrichtung nach Anspruch 1, wobei der Projektor (40) eine digitale Mikrospiegelanordnung oder eine Flüssigkristallvorrichtung verwendet.
 9. Vorrichtung nach Anspruch 1, wobei der Projektor (40) geeignet ist, um den Positions- (42) Indikator wenigstens teilweise außerhalb des Zielindicias für die Röntgenstrahlquelle zu projizieren.
 10. Vorrichtung nach Anspruch 1, wobei wenigstens einer der Sensoren (24, 24a, 24b) ein Hochfrequenzsendeempfänger ist.
 11. Vorrichtung nach Anspruch 1, wobei das projizierte Bild in der Erscheinung variiert gemäß dem Ausrichtungsoffset zwischen der Röntgenstrahlquelle (10) und dem intraoralen Bilddetektor (20).
 12. Verfahren zum Erhalten eines intraoralen Röntgenbildes, das Folgendes aufweist:
 - Emittieren einer Vielzahl von Signalen von Signalemittern (30) assoziiert mit einem intraoralen Bilddetektor (20);
 - Erfassen der Vielzahl von emittierten Signalen durch Nutzung von Sensoren (24, 24a, 24b), die in der Nähe der Röntgenstrahlquelle (10) positionell gekoppelt sind;
 - Berechnen einer Position und Winkelausrichtung des intraoralen Bilddetektors (20) bezüglich der Röntgenstrahlquelle (10) gemäß der erfassten Signale, wobei die Winkelausrichtung mit der Winkelausrichtung zwischen der Einfallstrahlung von der Röntgenstrahlquelle und einer normalen oder orthogonalen Linie zur Oberfläche des intraoralen Bilddetektors (20) in Beziehung steht;
 - dadurch gekennzeichnet, dass** das Verfahren ferner Folgendes aufweist:
 - Projizieren eines 2D-Bildes, das Positions- und Winkelausrichtungsinformation anzeigt zu der berechneten Detektorposition, wobei das 2D-Bild Zielindicia (12) für die Röntgenstrahlquelle einen Positions- (42) Indikator und einen Winkelausrichtungs-Offset-Indikator des intraoralen Bilddetektors (20) bezüglich der Röntgenstrahlquelle (10) zum Führen der Ausrichtungseinstellungen aufweist.
 13. Verfahren nach Anspruch 12, wobei das Projizieren des Bildes das Projizieren eines Umrisses, das den Bilddetektor (20) repräsentiert, aufweist.
 14. Verfahren nach Anspruch 12, wobei das Projizieren des Bildes das Projizieren eines Bildes, der den Bilddetektor (20) repräsentiert, aufweist und ferner das Nutzen einer Farbe aufweist, die die relative Größe eines Ausrichtungs-Offsets anzeigt.
 15. Verfahren nach Anspruch 12, wobei der Winkelausrichtungs-Offset-Indikator wenigstens eine numerische Nachricht und/oder Farbe umfasst.

Revendications

1. Procédé pour obtenir une image de rayons X intra-orale à partir d'un patient, le dispositif comprenant :

une source de rayons X (10) ;
un détecteur d'image intraorale (20) comprenant un ou plusieurs éléments détectables (30) ;
un ou plusieurs capteurs (24, 24a, 24b) couplés en position près de la source de rayons X (10) et actionnables pour détecter la position desdits un ou plusieurs éléments détectables (30) lorsque le détecteur d'image intraorale (20) est dans la bouche du patient ;

un processeur de logique de commande (26) en communication de signal avec lesdits un ou plusieurs capteurs (24, 24a, 24b) et agissant en réponse à des instructions mémorisées pour calculer un alignement de position et d'angle du détecteur d'image intraorale (20) par rapport à la source de rayons X (10), dans lequel l'alignement d'angle concerne l'alignement d'angle entre le rayonnement incident provenant de la source de rayons X et une normale, ou ligne orthogonale, à la surface du détecteur d'image intraorale (20) ; et

caractérisé en ce qu'il comprend en outre un projecteur (40) couplé en position à la source de rayons X (10) et en communication de signal avec le processeur de logique de commande (26) et actionnable pour projeter une image 2D comprenant un marqueur de cible (12) pour la source de rayons X, un indicateur de position (42), et un indicateur de décalage d'alignement d'angle du détecteur d'image intraorale (20) par rapport à la source de rayons X (10) en direction de la position de détecteur d'image intraorale (20) calculée en réponse à des signaux provenant du processeur de logique de commande (26).

2. Dispositif selon la revendication 1, dans lequel le détecteur d'image intraorale (20) est pris dans le groupe constitué d'un dispositif d'imagerie à film photosensible, d'un dispositif d'imagerie fluorescent de stockage, et d'un dispositif à détecteur numérique.
3. Dispositif selon la revendication 1, dans lequel le projecteur (40) est agencé pour projeter une image en utilisant un éclairage laser.
4. Dispositif selon la revendication 1, dans lequel au moins l'un desdits un ou plusieurs capteurs (24, 24a, 24b) est monté sur la source de rayons X (10).
5. Dispositif selon la revendication 1, dans lequel lesdits un ou plusieurs éléments détectables (30) sont agencés pour émettre un signal électromagnétique

à une fréquence radio ou de la lumière.

6. Dispositif selon la revendication 1, dans lequel lesdits un ou plusieurs éléments détectables (30) comprennent une pluralité d'émetteurs de signaux, chaque émetteur de signal étant actionnable pour émettre un signal électromagnétique à une ou plusieurs fréquences prédéterminées, et dans lequel lesdits un ou plusieurs capteurs (24, 24a, 24b) comprennent un ou plusieurs récepteurs de signaux couplés en position avec la source de rayons X (10) et actionnables pour recevoir les signaux électromagnétiques provenant des émetteurs de signaux.

7. Dispositif selon la revendication 1, dans lequel lesdits un ou plusieurs éléments détectables (30) comprennent un aimant.

8. Dispositif selon la revendication 1, dans lequel le projecteur (40) utilise un réseau de micro-miroirs numérique ou un dispositif à cristaux liquides.

9. Dispositif selon la revendication 1, dans lequel le projecteur (40) est adapté à projeter l'indicateur de position (42) au moins partiellement à l'extérieur du marqueur de cible pour la source de rayons X.

10. Dispositif selon la revendication 1, dans lequel au moins l'un des capteurs (24, 24a, 24b) est un émetteur-récepteur radiofréquence.

11. Dispositif selon la revendication 1, dans lequel l'image projetée varie en apparence en fonction d'un décalage d'alignement entre la source de rayons X (10) et le détecteur d'image intraorale (20).

12. Procédé pour obtenir une image de rayons X intra-orale comprenant :

émettre une pluralité de signaux à partir d'émetteurs de signaux (30) associés à un détecteur d'image intraorale (20) ;

détecter la pluralité de signaux émis en utilisant des capteurs (24, 24a, 24b) couplés en position près d'une source de rayons X (10) ;

calculer un alignement de position et d'angle du détecteur d'image intraorale (20) par rapport à la source de rayons X (10) en fonction des signaux détectés, l'alignement d'angle concernant l'alignement d'angle entre le rayonnement incident provenant de la source de rayons X et une normale, ou ligne orthogonale, à la surface du détecteur d'image intraorale (20) ;

caractérisé en ce que le procédé comprend en outre la projection d'une image 2D indicative des informations d'alignement de position et d'angle en direction de la position de détecteur calculée, dans lequel l'image 2D comprend un marqueur

de cible (12) pour la source de rayons X, un indicateur de position (42) et un indicateur de décalage d'alignement d'angle du détecteur d'image intraorale (20) par rapport à la source de rayons X (10) pour guider des ajustements d'alignement. 5

13. Procédé selon la revendication 12, dans lequel la projection de l'image comprend la projection d'un contour représentatif du détecteur d'image (20). 10
14. Procédé selon la revendication 12, dans lequel la projection de l'image comprend la projection d'une image représentative du détecteur d'image (20) et comprenant en outre l'utilisation d'une couleur qui indique la quantité relative d'un décalage alignement. 15
15. Procédé selon la revendication 12, dans lequel l'indicateur de décalage d'alignement d'angle comprend au moins l'un d'un message numérique ou d'une couleur. 20

25

30

35

40

45

50

55

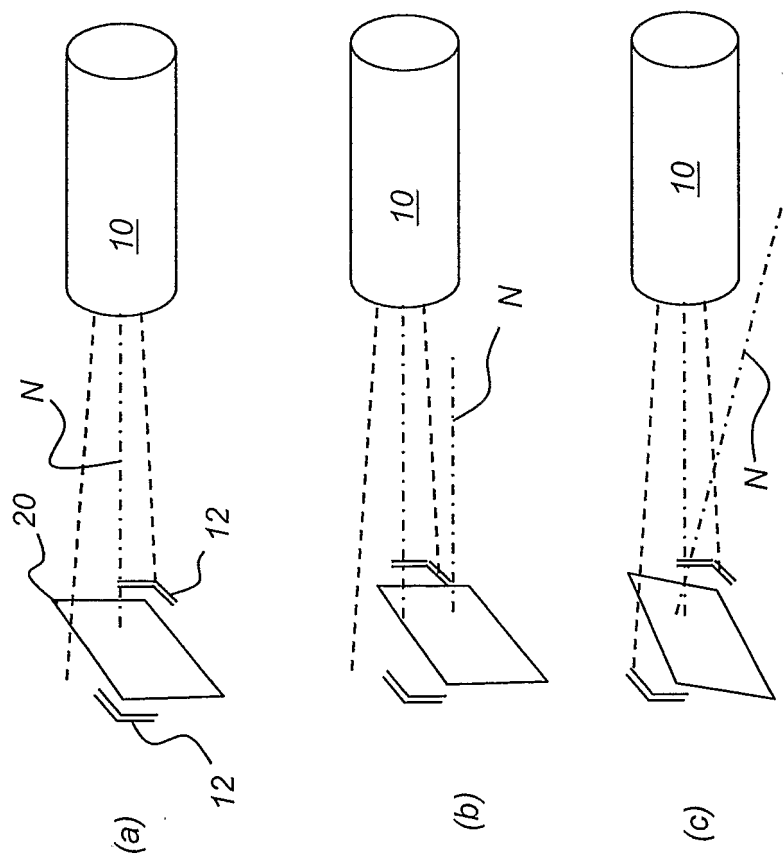


FIG. 1A

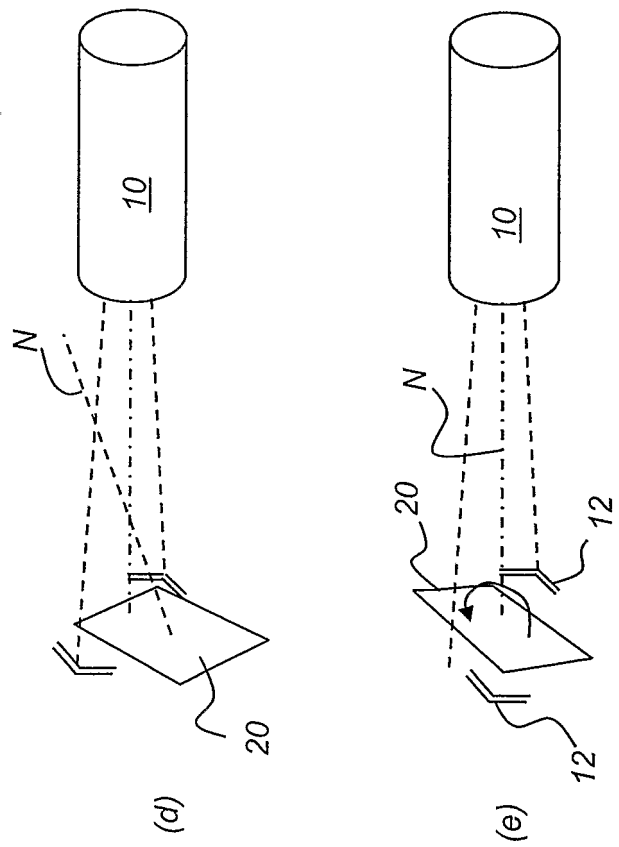


FIG. 1B

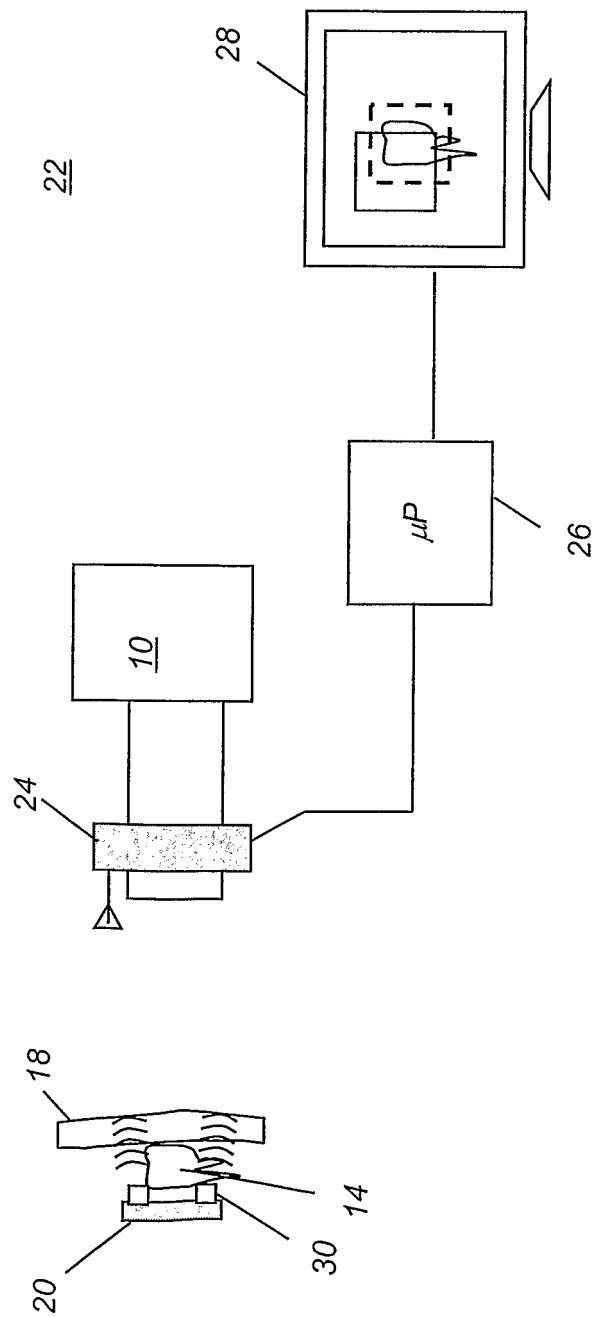


FIG. 2

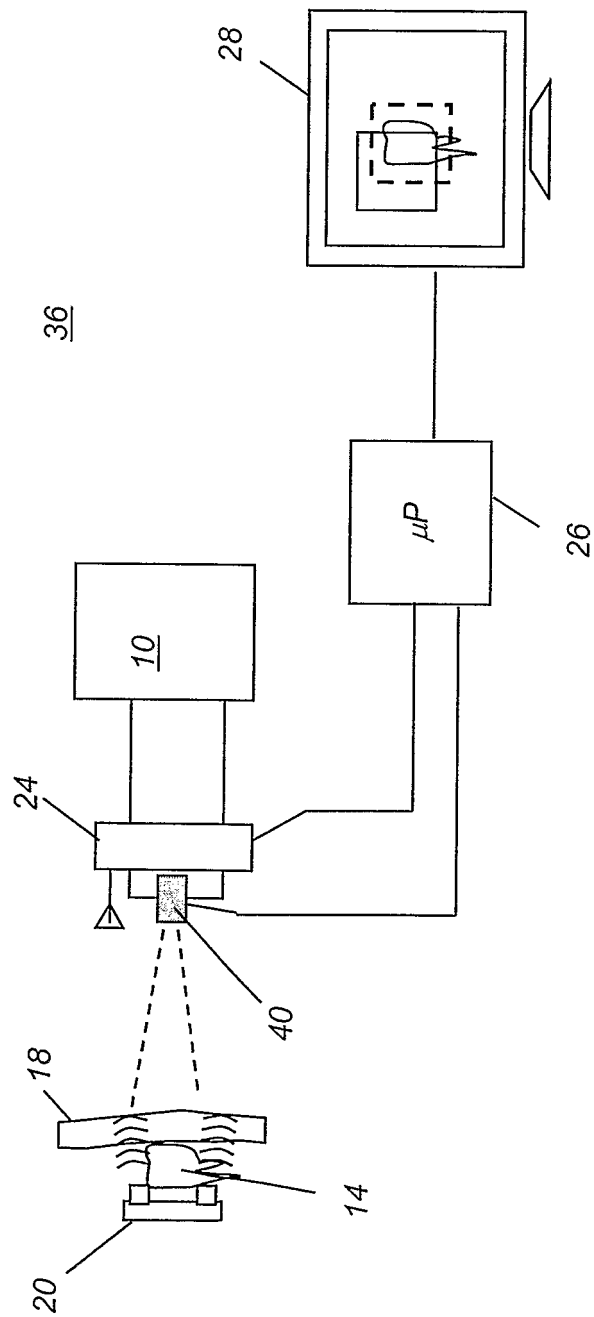


FIG. 3

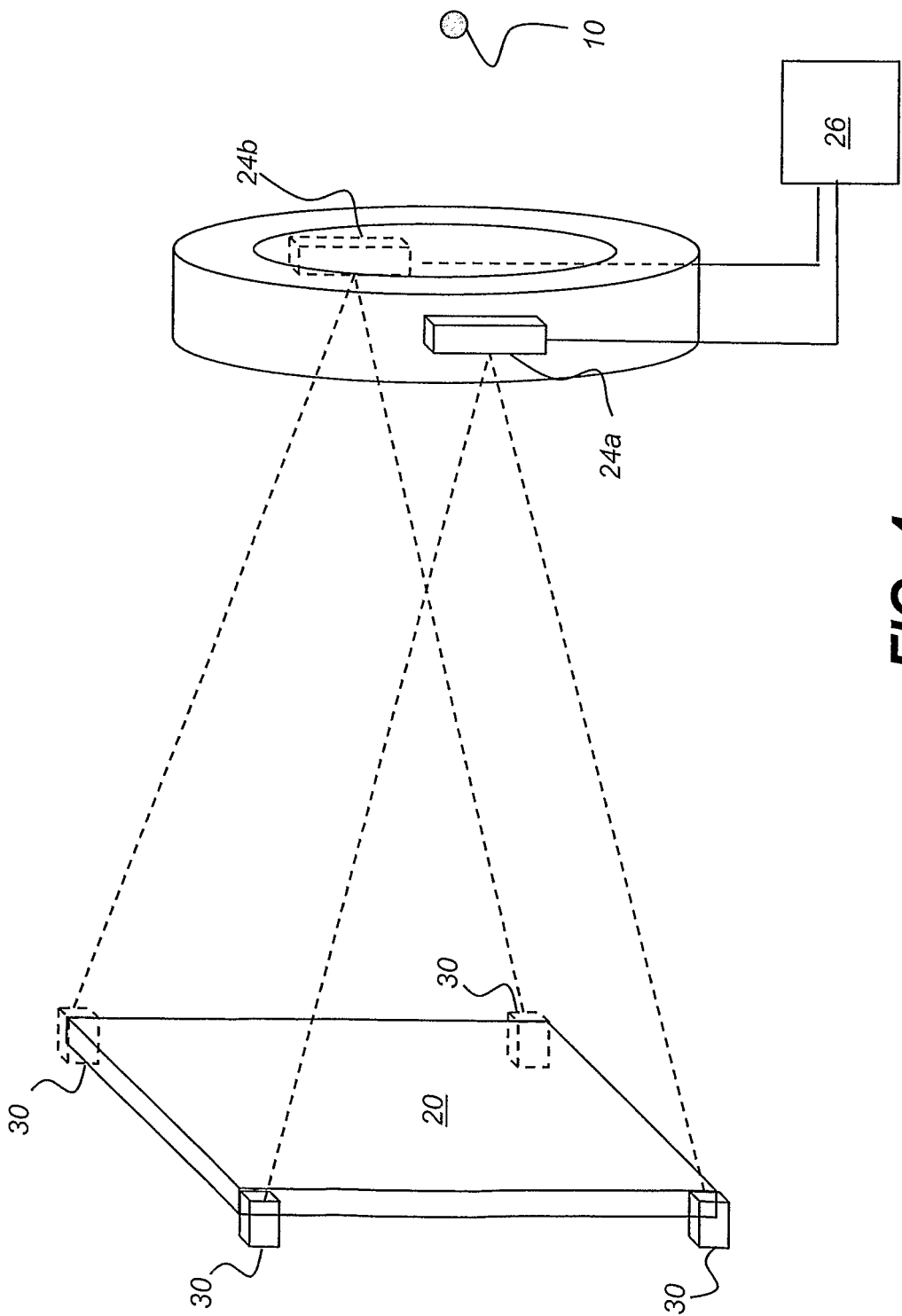


FIG. 4

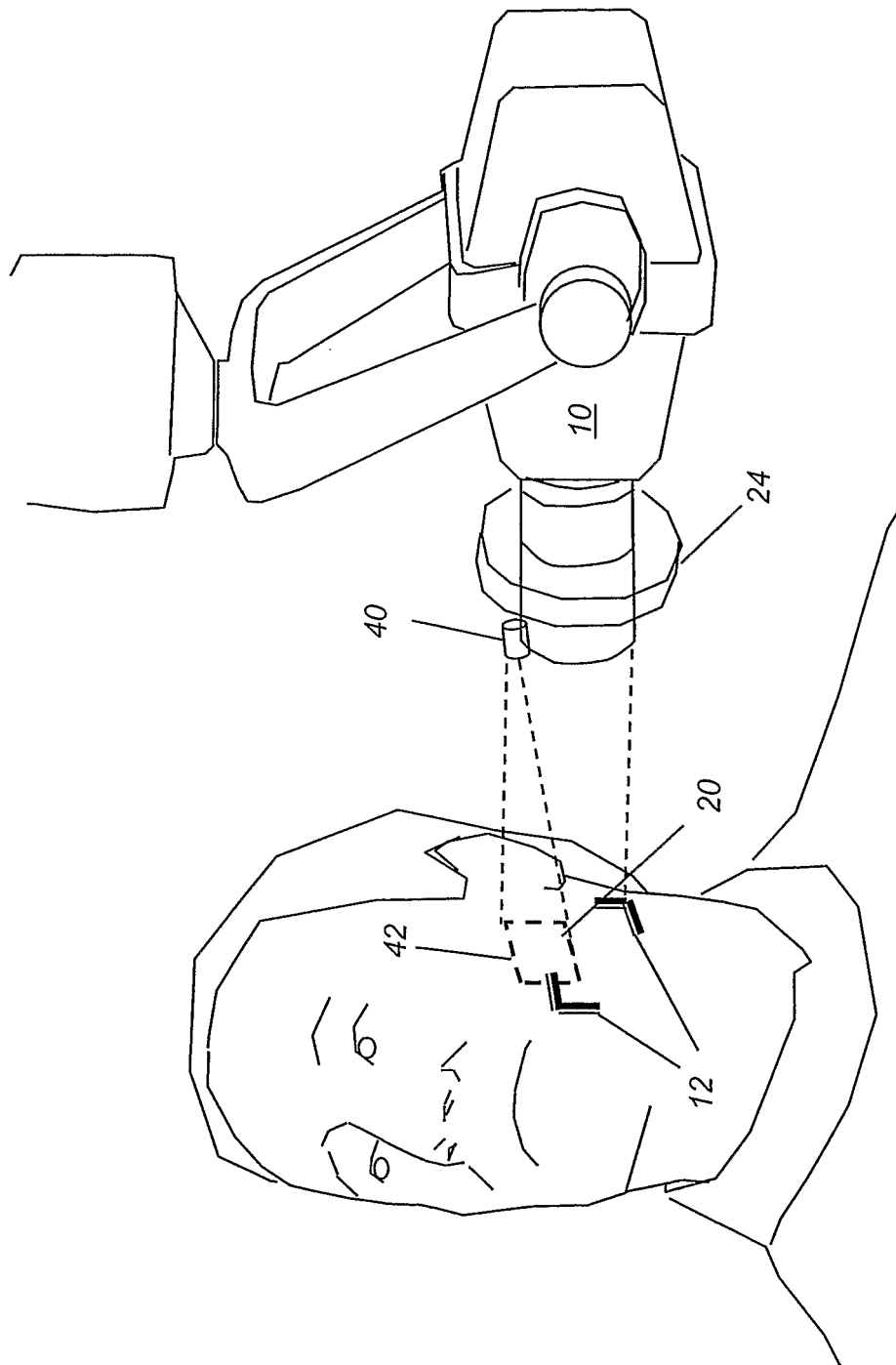
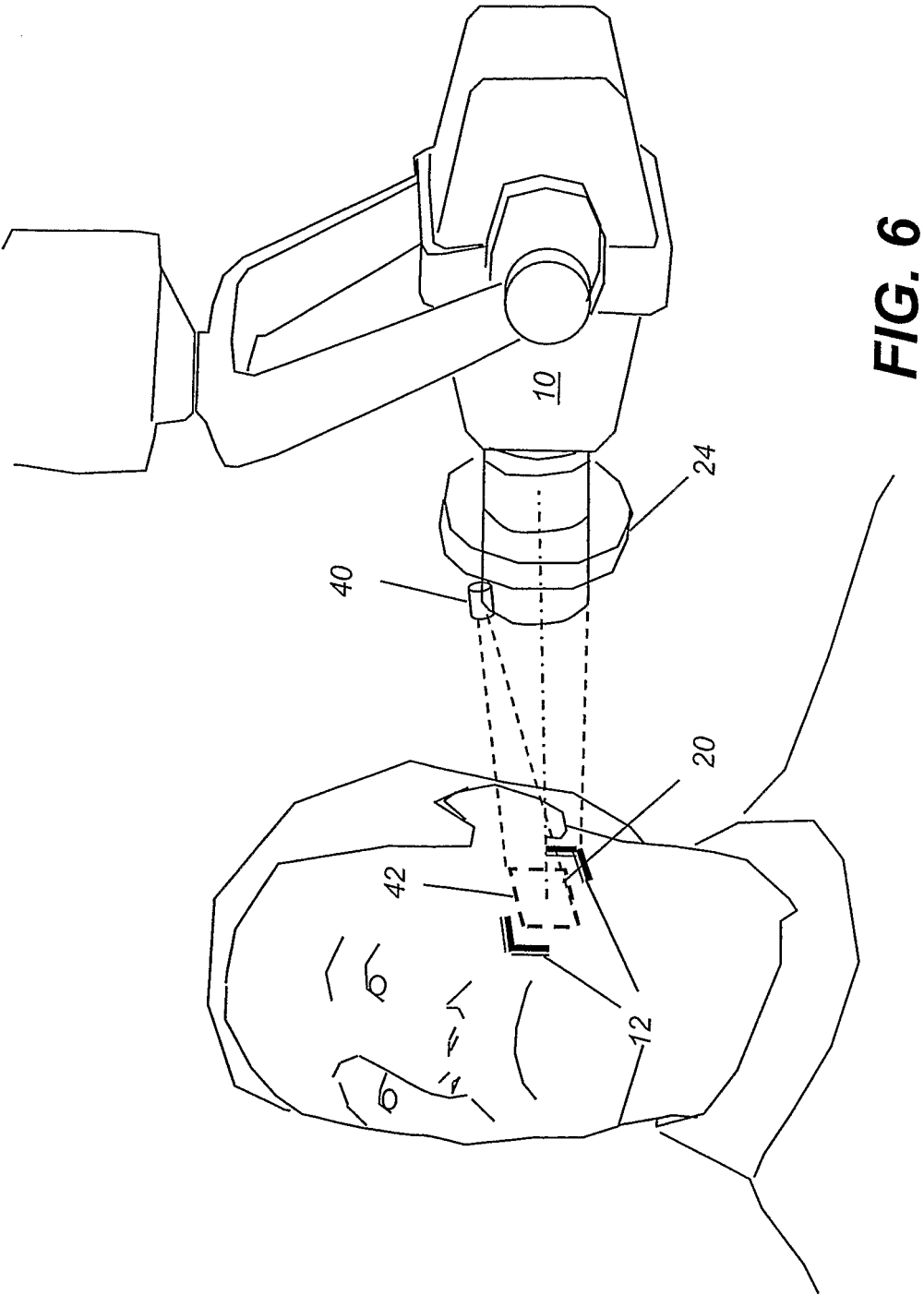


FIG. 5



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 20090060145 A [0008]
- WO 2006061357 A1 [0011]
- JP 2007029353 A [0012]